

## THE INFLUENCE OF THE PHYSICOCHEMICAL QUALITY OF SOME ASSORTMENTS OF TRADITIONAL CHEESES FROM DÂMBOVIȚA COUNTY DURING A YEAR

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### Abstract

*The physicochemical quality of traditional cheeses depends on the properties of the raw milk. Key parameters analysed include fat percentage, moisture, and dry matter. This study assesses these parameters in traditional cheeses from Dâmbovița County and tracks their evolution throughout the year. The analysed varieties telemea cheese, burduf cheese, and urda show variations, with fat percentage increasing over time. In cow's milk telemea cheese, fat rose from 47.43% (June) to 51.87% (November), while in burduf cheese, it increased from 41.28% (January) to 54.10% (November). Sheep's milk telemea cheese (61.02%) and sheep urda (84.41%) had the highest fat values, influenced by milk origin. Moisture and dry matter fluctuated, with alternating rising and falling trends. Fat percentage was the most influenced by seasonal factors, primarily due to the animal's physiological stage: early lactation, peak production, gestation onset, and late lactation. The findings highlight significant seasonal variations in cheese composition, underlining the importance of monitoring these parameters to ensure product quality.*

**Key words:** burduf cheese, telemea cheese, physicochemical quality, urda.

### INTRODUCTION

Cheese is a food product based on fermented milk. Cheese making involves a complex process involving interdependent chemical, biochemical, and microbiological changes (Cheung and Mehta, 2015). Cheese is a highly valued food in most human cultures, being present over time in people's daily lives. It is a food rich in nutritional components, being a source of proteins, fatty acids, minerals and vitamins, ranking among the most consumed foods globally due to its biologically active substances (Diana et al., 2014).

The diversity of cheeses available on the market is great, as there have been numerous technological advances in their manufacture and maturation over time (Pereira et al., 2009). The acceptance of an assortment of cheese by consumers depends in particular on its appearance, aroma and texture, which are in turn influenced by a combination of microbiological, biochemical and technological factors that modify the microstructure directly or indirectly (Pereira et al., 2009).

Cheese production in Romania has increased in the last 10 years from 66,290 tons to 96,400

tons, ranking 18th in the EU (Eurostat, 2018). One of the fundamental factors driving this growth was the development of small local factories, new varieties of cheese, and the growing market demand for traditional cheeses (Mureșan et al., 2021).

Artisanal food products are gaining more and more popularity, as they are perceived as local and authentic products (Cirne et al., 2019). These products usually benefit from a remarkable richness of taste, offering valuable organoleptic properties that are appreciated by consumers (Pasquali et al., 2022).

The exceptional quality of traditional cheeses is closely related to the fat content of the milk and its fatty acid profile. Milk fatty acids play an important role in the development of cheese flavours and tastes (Pop et al., 2013). During the ripening process, the breakdown of these fats leads to the formation of volatile compounds, which contribute to the unique taste and aroma characteristics of cheese (Mierlita et al., 2011). The chemical composition of milk is one of the main factors influencing cheese production. Since milk fat and protein are the main constituents of cheeses, the quality of the product is influenced by their concentrations in

milk (Bojanić Rašović et al., 2013). The chemical composition and physical properties of milk can vary, being influenced by different factors, which are reflected on the properties of the cheese. Variations in the amount and composition of milk are due to genetic factors (55%) or paragenetic factors, the most important of which is nutrition.

Other relevant paragenetic factors include: breed, feed type, lactation stage, age, milking quality, health status, environmental conditions (temperature, humidity, air circulation), mode of maintenance, etc. (Bojanić Rašović et al., 2017). Most cheese varieties can be classified by fat content, water content, and how maturation is achieved (Varnam and Sutherland, 2001). The physicochemical determinations that are the subject of the study are: determination of fat content, determination of moisture content and determination of dry matter content.

Each of these determinations reveals whether the traditional cheeses analysed are of a higher quality or not. For example, determining the percentage of fat is important because fat has numerous functions in cheeses, influencing the firmness, mouthfeel and flavour of cheese. It also contributes to the nutritional properties of cheese, as most cheeses contain significant amounts of fat (Fox et al., 2004).

Dry matter content determination provides information about the total amount of solids in cheeses, which includes fats, proteins, carbohydrates, minerals, and other nutrients. It can be used to evaluate the quality and consistency of cheeses. The water content of cheese is essential for its stability and shelf life. This study aims to qualitatively analyse the physicochemical properties, especially the percentage of fat, the percentage of moisture and the percentage of dry matter during a year and the influence of the seasons on these determinations.

## MATERIALS AND METHODS

The materials used in this study are traditional cheeses (telemea cheese, burduf cheese and urda), which come from local producers, as well as from distribution markets, thus having access to a wide variety of products. It is worth mentioning that the origin of milk is not always known. The samples were collected from

batches of varying sizes, depending on the cheese assortment analysed. The batches ranged from about 15 kg, to large lots, about 250 kg.

The samples were collected in Dâmbovița County, Moroieni commune, being a region famous for its traditions in the production of traditional cheeses, but also other artisanal products. This selection of the study area was supported by its reputation, locally, in terms of the quality and diversity of traditional products. The sample collection process started in January 2024 and was completed in November of the same year, thus ensuring relevant coverage of seasonal diversity and possible fluctuations in milk composition throughout the seasons.

The samples collected consisted of the selection of the following assortments within which several varieties are distinguished:

Telemea cheese - comprising a total of 60 samples analysed; this assortment presents the following varieties: cow's milk cheese (19 samples collected from batches between 50 and 100 kg), sheep's milk cheese (10 samples collected from batches between 8 and 30 kg), aged cow's milk cheese (10 samples collected from batches between 83 and 150 kg), aged sheep's milk cheese (5 samples collected from batches of 20 and 47 kg), fresh cheese from cow's milk (10 samples collected from batches between 14 and 20 kg), fresh sheep's milk cheese (7 samples collected from batches between 19 and 27 kg).

Burduf cheese - comprising a total of 60 samples analysed and collected from batches between 20 and 250 kg.

Urda - comprising a total of 40 samples analysed; this assortment presents the following varieties: sweet urda (15 samples collected from batches between 14 and 26 kg), salted urda (5 samples collected from batches between 25 and 34 kg), cow's milk urda (10 samples collected from parrots between 12 and 30 kg), sheep's milk urda (3 samples collected from batches of 13, 14 and 15 kg).

The methods used to determine the fat content of cheeses were two in number, namely:

*The Van Gulik method or ISO 3433/2008*: it was developed by the Dutch chemist Cornelis van Gulik in the 1930s and is still used today in the food industry. This method is based on the principle of solubility of fats in ethyl ether. The process involves extracting fats from a sample

of cheese using ethyl ether as a solvent. The extracted fats are weighed and expressed as a percentage of the total mass of the cheese. The Van Gulik method is one of the standard methods used in lactic analysis, being recognized for its accuracy and for the fact that it can be widely applied in the cheese industry (ISO 3433, 2008).

*SR EN ISO 1211/2010* is an international standard that establishes a method for determining the fat content of dairy products and cheeses. This standard is issued by the International Organization for Standardization (ISO) and is adopted in Romania, under the SR (Romanian Standard) logo. The method involves extracting fat from a sample of dairy product or cheese using an organic solvent, usually ethyl ether or heptane. After extraction, the fats are separated from the solvent, and their weight is determined by evaporation or other drying methods. The fat content is then expressed as a percentage of the total mass of the product. The use of this standard helps to ensure the quality and safety of food, as well as to the protection of consumers' interests (ASRO, 2010).

The method used to determine the dry matter content of cheeses was:

*ISO 5534/2004 I* standard: is an international standard issued by the International Organization for Standardization (ISO) and refers to the determination of dry matter in milk and dairy products at 102°C by the gravimetric method. This standard describes a method for determining the dry matter content in milk and dairy products by drying samples at 102°C and measuring their weight. This is considered a reference method for determining the dry matter content and is used to ensure the accuracy of the analysed results (ISO 5534, 2004).

The determination of the moisture content was carried out by the extraction method, according to the ISO 5534/2004 I Standard, using the values obtained for the analysis of the dry matter. The moisture calculation was made by difference, subtracting the percentage of dry matter from 100%.

## RESULTS AND DISCUSSION

Within the telemea cheese varieties, the values for each parameter analysed are presented in the following table (Table 1). As can be seen, the

highest (average) percentage of fat in cheese belongs to the sheep cheese variety (62.56%), a percentage due to the large amount of fat in sheep's milk. The lowest (average) percentage is recorded for fresh cow's cheese (49.86%), a percentage similar to that of the cow's cheese variety (49.79%).

Table 1. Physicochemical parameters of the varieties of telemea cheese

| Assortment                 | The physicochemical parameters investigated (average) |                      |                        |
|----------------------------|-------------------------------------------------------|----------------------|------------------------|
|                            | Fat content (%)                                       | Moisture content (%) | Dry matter content (%) |
| Cow's milk telemea         | 49.79                                                 | 49.58                | 50.42                  |
| Sheep's milk telemea       | 62.56                                                 | 48.37                | 51.63                  |
| Aged cow's milk telemea    | 52.82                                                 | 48.69                | 51.31                  |
| Aged sheep's milk telemea  | 60.17                                                 | 51.02                | 48.98                  |
| Fresh cow's milk telemea   | 49.86                                                 | 51.47                | 48.53                  |
| Fresh sheep's milk telemea | 58.88                                                 | 49.27                | 50.73                  |

The highest values of the average moisture percentage were recorded in the varieties of fresh cow's milk telemea (51.47%) and aged sheep's milk telemea (51.02%). The lowest values were recorded for sheep milk telemea cheese (48.37%). The values of the dry matter are similar, but qualitatively different from those of the percentage of moisture. Radulović et al. (2011) demonstrated by analysing cow cheese that the dry matter values did not exceed 47.14%, which is a relatively low percentage. On the other hand, the values of the fat percentage were on average 60.00%, values significantly higher than those obtained in the present study. Angheloiu et al. (2016) state that matured telemea cheese has a higher amount of dry matter, which is also observed in this study if we compare the fresh and old varieties of telemea cheese where differences of 2-3% can be observed. Teneva-Angelova et al. (2018) state that following research in the Balkan Peninsula, the average moisture percentage of telemea cheese was 52.5%, a value that exceeds the results obtained in the present study. Neagu

et al. (2013) concluded that the average fat percentage was 50.54%, and the dry matter percentage was 44.16%. The distribution by seasons is difficult to interpret considering the multiple varieties of this assortment, however we will present the evolution of the analysed parameters of the cow cheese variety in the following table (Table 2) and schematically average (Figure 1 and Figure 2), because 10 samples belonging to both the summer and autumn seasons were collected.

Tabel 2. The evolution of the physicochemical parameters of the cow's telemea cheese variety

| Assortment         | Month of the year | The physicochemical parameters investigated (average) |                      |                        |
|--------------------|-------------------|-------------------------------------------------------|----------------------|------------------------|
|                    |                   | Fat content (%)                                       | Moisture content (%) | Dry matter content (%) |
| Cow's milk telemea | 6                 | 47.43                                                 | 48.91                | 51.09                  |
| Cow's milk telemea | 7                 | 48.71                                                 | 49.51                | 50.49                  |
| Cow's milk telemea | 8                 | 49.77                                                 | 49.38                | 50.62                  |
| Cow's milk telemea | 9                 | 50.11                                                 | 47.93                | 52.07                  |
| Cow's milk telemea | 10                | 50.96                                                 | 48.98                | 51.02                  |
| Cow's milk telemea | 11                | 51.75                                                 | 52.57                | 47.43                  |

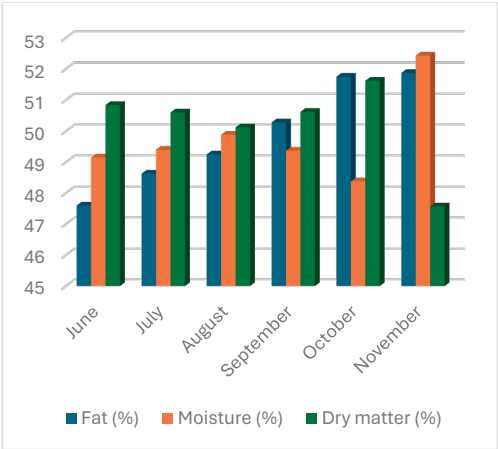


Figure 1. Changes in the physicochemical characteristics of cow's milk telemea cheese

As can be seen in the figures and table presented above, the fat percentage has a continuous increase starting from 47.43% in June and reaching 51.75% in November.

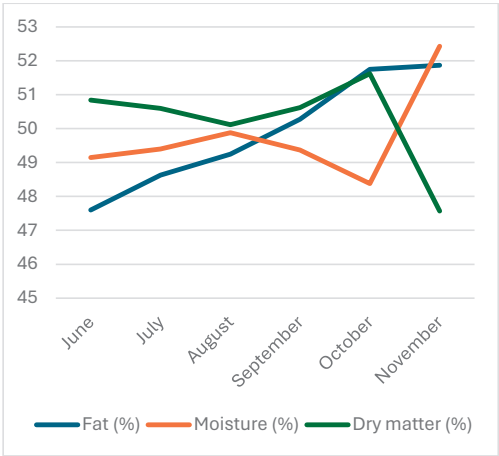


Figure 2. Evolution of the physicochemical properties of cow's milk telemea cheese

These variations are normal considering the physiological stage in which the animals are, namely the end of lactation and the onset of gestation. The other parameters vary from one month to another, with upward and downward trends in the summer months, and at the end of autumn they will be inversely proportional.

The following table (Table 3) shows the variations in the physicochemical parameters of burduf cheese depending on the month in which they were collected and analysed.

As can be seen, the values of physicochemical parameters differ from month to month. The fat percentage is the one that follows the most obvious upward course, having minimum (average) values in January (42.68%) and reaching (average) values of 53.89% in October and November.

In the table, three values appear for each month, representing the average of the samples collected closer to the beginning, middle, or end of the month. The lowest value of fat percentage is recorded in January (41.28%), and the highest value in November (54.10%). The values of the other parameters undergo changes during the year, not being very significant. The average values of moisture percentage and dry matter percentage in January were 47.84% and 51.41%, respectively, compared to 52.3% and 47.70% respectively in the last two months. Variations in fat percentage can also be due to the physiological stage of the animals, but also to the feeding conditions.

Table 3. Variations in the parameters of burduf cheese depending on the season

| Assortment    | Month of the year | The physicochemical parameters investigated |                      |                        |
|---------------|-------------------|---------------------------------------------|----------------------|------------------------|
|               |                   | Fat content (%)                             | Moisture content (%) | Dry matter content (%) |
| Burduf cheese | 1                 | 41.25                                       | 46.36                | 53.64                  |
| Burduf cheese | 1                 | 45.53                                       | 46.55                | 53.45                  |
| Burduf cheese | 1                 | 41.28                                       | 50.62                | 49.38                  |
| Burduf cheese | 2                 | 42.79                                       | 51.48                | 48.52                  |
| Burduf cheese | 2                 | 41.59                                       | 50.61                | 49.39                  |
| Burduf cheese | 2                 | 41.63                                       | 46.47                | 53.53                  |
| Burduf cheese | 3                 | 43.47                                       | 54.87                | 45.13                  |
| Burduf cheese | 3                 | 46.28                                       | 52.32                | 47.68                  |
| Burduf cheese | 3                 | 47.21                                       | 49.95                | 50.05                  |
| Burduf cheese | 4                 | 46.28                                       | 56.95                | 43.05                  |
| Burduf cheese | 4                 | 47.58                                       | 55.02                | 44.98                  |
| Burduf cheese | 4                 | 48.74                                       | 48.63                | 51.37                  |
| Burduf cheese | 5                 | 49.85                                       | 46.68                | 53.32                  |
| Burduf cheese | 5                 | 49.57                                       | 48.46                | 51.54                  |
| Burduf cheese | 5                 | 49.72                                       | 47.14                | 52.86                  |
| Burduf cheese | 6                 | 49.33                                       | 54.79                | 45.21                  |
| Burduf cheese | 6                 | 47.48                                       | 45.15                | 54.85                  |
| Burduf cheese | 6                 | 48.74                                       | 50.17                | 49.83                  |
| Burduf cheese | 7                 | 49.42                                       | 48.14                | 51.86                  |
| Burduf cheese | 7                 | 50.59                                       | 49.25                | 50.75                  |
| Burduf cheese | 7                 | 51.42                                       | 50.14                | 49.86                  |
| Burduf cheese | 8                 | 51.64                                       | 49.14                | 50.86                  |
| Burduf cheese | 8                 | 52.24                                       | 55.21                | 44.79                  |
| Burduf cheese | 8                 | 52.50                                       | 48.48                | 51.52                  |
| Burduf cheese | 9                 | 51.63                                       | 49.89                | 50.11                  |
| Burduf cheese | 9                 | 51.98                                       | 48.85                | 51.15                  |
| Burduf cheese | 9                 | 52.26                                       | 55.78                | 44.22                  |
| Burduf cheese | 10                | 53.78                                       | 53.34                | 46.66                  |
| Burduf cheese | 10                | 53.57                                       | 53.27                | 46.73                  |
| Burduf cheese | 10                | 53.79                                       | 47.32                | 52.68                  |
| Burduf cheese | 11                | 54.01                                       | 50.91                | 49.09                  |
| Burduf cheese | 11                | 53.98                                       | 52.72                | 47.28                  |
| Burduf cheese | 11                | 54.10                                       | 56.24                | 43.76                  |

Kondyli et al. (2012) state that there are seasonal differences in the amount of fat in milk. Animals towards the end of the lactation period secrete less milk, but with a greater amount of fat.

Pop et al. (2013), state that following an analysis on burduf cheese, values of 19.50% fat and 46.00% dry matter were recorded. Values that are lower than those presented in this study. Neagu et al. (2013) concluded that the average fat percentage was 45.75%, and the average dry matter percentage was 47.62%. For a better visualization of the results, below we will present two graphical representations.

The first figure (Figure 3) represents the average values of the physicochemical parameters analysed in the first half of the year, while the second figure (Figure 4) presents the data for the second half of the year.

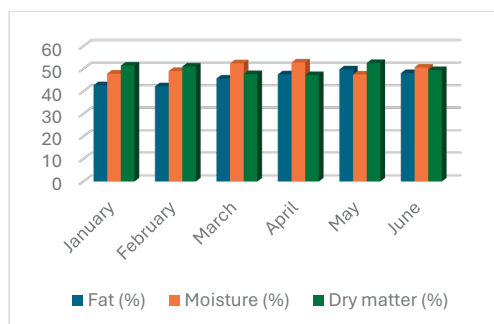


Figure 3. Average physicochemical properties of burduf cheese in the first half of the year

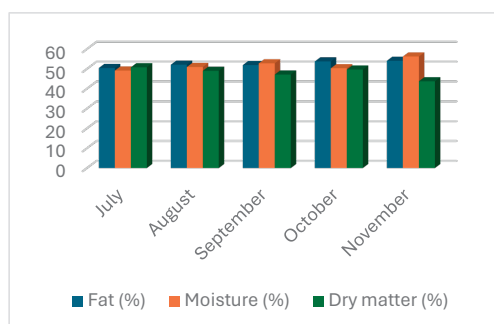


Figure 4. Average physicochemical properties of burduf cheese in the second half of the year

The following graphic representation (Figure 5) represents the variation of the fat percentage during the year, being the parameter at which a significant and continuous increase is observed.

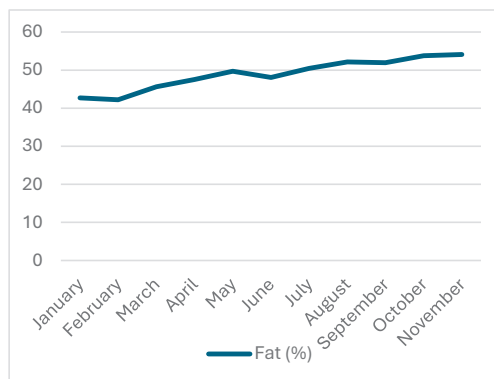


Figure 5. Variations in the fat percentage of burduf cheese throughout the year

The physicochemical properties of urda have been presented (Table 4) as follows. In the following table, four varieties of urda are represented. As can be seen, the sweet urda

variety showed high values of fat percentage (85.56%) in July, representing the highest value recorded. High values of fat percentage were also obtained by the varieties salted urda (84.24%), sheep's milk urda (84.41%) and cow's milk urda (70.10%). The lowest values were recorded for cow's milk urda varieties (52.35% and 55.51%). The percentage of humidity varied during the summer and autumn months, registering the lowest value within the sheep's milk urda assortment (57.11%), and the highest cow's milk urda (71.18%). The percentage of dry matter varied during the study, registering low values within the cow's milk urda assortment (28.82%), and the high values were recorded by the salted urda variety (43.09%). Bojanic Rasovic et al., (2017) state that analysing the samples of urda from Montenegro they concluded that the percentage of fat did not exceed 35.65%, with a percentage of moisture 63.86% and a percentage of dry matter that did not exceed the value of 52.25%. The fat percentage is much lower than in the present study, the other determinations are relatively similar.

Table 4. The average values of the physicochemical properties of urda cheese

| Assortment        | Month of the year (average) | The physicochemical parameters investigated |                      |                        |
|-------------------|-----------------------------|---------------------------------------------|----------------------|------------------------|
|                   |                             | Fat content (%)                             | Moisture content (%) | Dry matter content (%) |
| Sweet urda        | 5                           | 79.50                                       | 66.05                | 33.95                  |
| Sweet urda        | 6                           | 62.55                                       | 60.49                | 39.51                  |
| Sweet urda        | 7                           | 85.56                                       | 59.47                | 40.53                  |
| Salted urda       | 6                           | 59.06                                       | 64.67                | 35.33                  |
| Salted urda       | 7                           | 60.32                                       | 57.05                | 42.95                  |
| Salted urda       | 8                           | 68.30                                       | 56.91                | 43.09                  |
| Salted urda       | 9                           | 83.82                                       | 56.98                | 43.02                  |
| Salted urda       | 10                          | 84.24                                       | 57.97                | 42.03                  |
| Cow's milk urda   | 8                           | 52.35                                       | 60.74                | 39.26                  |
| Cow's milk urda   | 9                           | 55.51                                       | 71.18                | 28.82                  |
| Cow's milk urda   | 10                          | 58.97                                       | 60.39                | 39.61                  |
| Cow's milk urda   | 11                          | 70.10                                       | 66.33                | 33.67                  |
| Sheep's milk urda | 10                          | 80.21                                       | 57.11                | 42.89                  |
| Sheep's milk urda | 11                          | 84.41                                       | 58.28                | 41.72                  |

Pappa et al., (2016) state that the percentage of moisture in the urda variety of sheep's milk was 56.97%, and the percentage of fat was 28.28%, a much lower value than the results obtained in the present study. Snežana Paskaš et al., (2019) determined an average moisture percentage of 79.59% with an average fat percentage of 5.63%.

If we analyse the distribution of the fat percentage according to the season, we can say that a slight but continuous increase is observed, from May to November. Of course, it is difficult to make a statistic due to the multiple varieties of its assortment. Considering the results obtained by other researchers, we can say that the analysed urda varieties meet all the criteria of a superior, nutritious and healthy product from a physicochemical point of view.

## CONCLUSIONS

The collection and analysis of the samples took place over a period of 11 months, starting in January 2024 and ending in November 2024. During this period, a total of 160 samples were collected and analysed. The assortments of traditional cheeses analysed, as they were presented, were: telemea cheese, burduf cheese and urda. Within these assortments, several varieties are distinguished, mainly depending on the origin of the raw material and the method of preservation. The study was carried out in Dâmbovița County, Moroieni commune, with the aim of establishing the physicochemical quality of the assortments of traditional cheeses analysed.

The physicochemical quality was established following the determination of the main parameters that attest to the superior quality of cheeses, namely: the percentage of fat, the percentage of moisture and the percentage of dry matter.

Within the telemea cheese assortment, the values of the main physicochemical parameters are closely related to the raw material from which it is obtained. Thus, the values of the fat percentage were reduced in the varieties of cow's milk telemea cheese (49.79%) and fresh cow's milk telemea cheese (49.86%), the highest values were recorded in the varieties of sheep's milk telemea cheese (62.56%) and aged sheep's milk telemea cheese (60.17%). The percentage



of moisture and the percentage of dry matter varied slightly from one variety to another; the lowest values were 48.37% (sheep's milk telemea cheese - percentage of moisture) and 48.98% (aged sheep's milk telemea cheese - percentage of dry matter). The highest values were for the percentage of moisture 51.47% (fresh cow's milk telemea cheese) and for the percentage of dry matter 51.63% (sheep's milk telemea cheese). Separately, the cow's milk telemea cheese was analysed where the trend of increasing the fat percentage over the analysed period was observed, starting from values of 47.43% in June and reaching 51.87% in November.

In burduf cheese, due to the large number of samples analysed and the uniformity of the distribution on lines, the increase in the percentage of fat is the most obvious parameter observed. The lowest value was recorded in January (41.28%), and the highest in November (54.10%), with an increase of 12.82% over the 11 months. The other parameters analysed did not vary much during the year, so the average for the first half of the year was 49.93% moisture percentage and 49.84% dry matter percentage. For the second half of the year, the values were 51.17% for the percentage of humidity and 48.82% for the percentage of dry matter.

Within the urda varieties, an increase in the percentage of fat can be observed from one month to the next. Thus, the sweet urda variety varied between 62.55% and 85.56%, the salted urda variety between 59.06 and 84.24%, the cow's milk urda variety between 52.35% and 58.97%, and the sheep's milk urda variety between 70.10% and 84.41%. In the other determinations, very wide variations were not observed, with slight growth trends followed by slight decreases depending on the parameter.

In conclusion, the results obtained demonstrate that the analysed cheese varieties are of superior quality from a physicochemical perspective and the percentage of fat is most influenced by the succession of seasons, being low in winter and spring, increasing in summer and reaching the highest levels in autumn, in general, due to the physiological stage of the animals, as well as the temperature, grazing conditions, and the quality of green forage.

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